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PARTICLE BOARD COMPRISING MAGNESIA-BASE CEMENT AND A POLYELECTROLYTE

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This application is a continuation-in-part of my application, Ser. No. 278,462, filed May 6, 1963.

The present invention relates to the preparation of shaped articles formed by binding particles of wood together with various binder compositions. More specifically, the invention concerns the use of certain organic polymeric binder materials in conjunction with wood particles and either with or without an inorganic magnesia-base cementitious binder to provide particle boards having improved physical characteristics.

Wood particle board is prepared by a variety of methods which basically involve the application of pressure and heat to a mixture of wood particles and a binder material to form a cohesive mass. This final particle board product may be of a single or multiple layer construction. The wood particles are generally employed in the form of splinters, chips, flakes, shavings and sawdust which are admixed with an organic or inorganic binder material, e.g. urea-formaldehyde resin or inorganic magnesia-base cements, to provide a particulate, composite mass. This mass is generally formed into a mat which subsequently hardens or "sets" to form a relatively rigid board structure. The formation of this board is usually facilitated by the application of heat and pressure to the mat.

It is an object of the present invention to provide a particle board with improved strength and moisture resistant qualities. It is another object of the invention to provide a particle board having a decorative surface appearance. It is also an object of the invention to provide a method for the manufacture of such particle board. Other objects will become apparent hereinafter as the present invention is more fully described.

The general method of the present invention comprises the steps of pre-treating a quantity of wood particles with a small amount of a suitable synthetic water-soluble polyelectrolyte and then applying to the pre-treated wood particles an inorganic magnesia-base cementitious binder in the form of an aqueous slurry. The resulting polymer-treated wood particle-binder composite is utilized in the manufacture of an improved wood particle board.

In an alternative procedure, the water-soluble polyelectrolyte is added directly to the inorganic magnesia-base binder slurry and the polymer and binder components, combined in this slurry, are sprayed onto the wood particles.

Wood particle boards may also be prepared utilizing only the water-soluble polyelectrolytes as binders or adhesion improvers and without the use of magnesia-base inorganic binders.

Wood particles suitable for use in the present invention are those conveniently employed in the manufacture of particle board. Such particles include a wide variety of mechanically formed wood particles ranging in size from sawdust to relatively large chips, flakes, splinters, shavings and the like. These wood particles, which may be classified according to sizes and types of wood are obtained by mechanically working larger pieces of wood stock.

Polymers suitable for use in the present invention are synthetic water-soluble cationic and anionic polyelectrolytes which contain ionic groups either appended to or forming part of the polymer chain. Representative examples of such polymers include polyalkylenimines, polyalkylenepolyamines, polyvinylbenzyl dialkanol sulfonium halides, alkali metal salts of polyvinylarene sulfonic acids such as sodium polystyrenesulfonate, and the like.

These polymers are incorporated in the inorganic magnesia-base binder composition-wood particle mixture prior to formation of the particle board product. The polymer is usually added to an aqueous slurry of the inorganic binder composition or the wood particles are pre-treated with an aqueous solution of the polyelectrolyte prior to mixing the particles and binder. The pre-treatment is accomplished by any convenient procedure such as immersing, sprinkling, spraying and the like. A preferred procedure involves spraying an aqueous solution of the polymer onto the wood particles as they are agitated as for example in a rotary mixer such as a cement mixer. A similar type of operation may be employed wherein an aqueous mixture of polymer and inorganic binder is sprayed onto the tumbled wood particles. Sufficient quantities of polymer are employed to provide a polymer content in the resulting composite mass of from about 0.15 to 2.0 weight percent. It should be noted that the efficiency of incorporation of the polymer and binder in the composite mass formed will vary when different mixing techniques are utilized. An average loss of about 30 weight percent of the polymer and inorganic binder has been observed in small scale experiments and the initial amounts of these components utilized in preparing the mixture of polymer, inorganic binder and wood particles must be accordingly adjusted to provide the desired content in the composite mass which is utilized, after the pre-treatment step, in subsequent operations which produce the desired particle board.

The binder employed in admixture with the wood particles is selected from a variety of known inorganic magnesia-base materials and mixtures of such materials which display the ability to cure or harden into cements. Examples of these are magnesium oxychloride, magnesium oxybromide and magnesium oxysulfate cements. A preferred inorganic binder is magnesium oxychloride employed at a $MgO:MgCl_2$ mol ratio of about 6:1 and in sufficient quantity to provide about 15 parts by weight of binder solids to 100 parts by weight of dry wood particles in the composite mass resulting from the previously described mixing procedure. The amount of binder employed may be as little as that amount needed to provide 10 weight percent binder solids in the final board product. The use of a low percentage of binder such as this will yield a low cost, low quality board suitable for many purposes. The use of twice this amount of binder will yield a much higher quality and more fire-resistant particle board product.

In the particle board forming operation, measured quantities of the above-described composite mass are placed in a deckle box or spread on metal cauls to form mats which are generally compacted at normal room temperature in a pre-pressing operation. If a single layer board is to be produced, the mat is then subjected to heat and pressure as later described. If, however, a sandwich-type of multi-layer board is desired, a series of mats may be prepared and formed into a multi-layer sandwich structure prior to proceeding with the final pressing operation. It should be noted that, if desired, the polymer-containing wood particle-binder composite may be employed only in certain layers such as the facing layers wherein this composite is most effective in improving the overall characteristics and appearance of the multi-layer particle board. Likewise, the various layers may utilize different types of wood particles as for example where sawdust may be employed to furnish a core layer which is sandwiched between two facing layers containing wood flakes thus providing an attractive appearance while utilizing a lower cost core material.